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## DIPHTHERIA

BY ALBERT D. KAISER, M.D.

*Rochester, N. Y.*

Diphtheria still belongs in the class of dangerous diseases but its dangers can now be faced by physicians with a certain, superior calmness. The term diphtheria has been applied since the time of Bretonneau and his pupils, nearly a hundred years ago, to a disease of the mucous membranes of the skin which occurred in epidemics and spread by contagion. Before that time physicians had been acquainted with the local manifestations of the disease. The exciting cause of the scourge was first discovered by Klebs and Loeffler in 1883, after whom the organism causing the disease is named. Ten years later the antitoxin was discovered but several years elapsed before it was possible to overcome the opposition to its use.

Diphtheria is seen in all climates and seasons but is more prevalent in cold countries and during the colder months. While in the earlier centuries it apparently always occurred in more or less sharply defined epidemics, by the middle of the nineteenth century it had become pandemic owing to the development of commerce with more rapid means of transportation, so that now the disease practically never dies out in large cities. It has been pointed out recently that diphtheria epidemics occur cyclically. During the last forty years a number of such epidemics have been recorded at various intervals. The causes of these epidemic outbreaks are not clear but they may be due to such a circumstance as a new crop of susceptible children. It is said that diphtheria prevails more in rural districts but everyone is familiar with outbreaks in certain congested districts, schools or institutions.

Diphtheria is primarily a disease of children though adults are not exempt. The greatest number of cases occur in children between the ages of two and five years. From immunity tests which have recently been worked out, it has been learned that 50 per cent of the children between two and five years of age are susceptible to diphtheria while less than 10 per cent of adults would develop the disease if exposed. An attack of diphtheria may or may not give a permanent immunity. Repeated attacks are common, necessitating precautions to prevent subsequent attacks. A short period of immunity can be secured by small injections of antitoxin.

The germ causing diphtheria is a little bacillus which almost always enters by the mouth or nose and the lesions are usually localized in the mucous membranes of the throat, nose, larynx or upper respiratory tract. The bacillus also leaves the body in the discharges from the nose and mouth. The diphtheria bacillus grows readily in any albuminous medium with an alkaline reaction. It can easily be grown in culture media. The resistance of the bacillus to changes of temperature varies. Exposure to cold temperature is well borne but 120° Fahrenheit, or higher, causes it to succumb in a short time. The bacilli are also sensitive to such chemicals as alcohol, lysol, phenol, and bichloride of mercury. Their resistance to drying is very marked, especially if they are enclosed in bits of membranes and are not exposed to diffused sunlight.

The diphtheria bacillus is generally transmitted directly from one person to another as by kissing or exposure to droplet infection in coughing, speaking and sneezing; or the infection may be conveyed indirectly from one person to another in a great variety of ways, most common among children, perhaps, are toys, slate pencils, food, fingers, handkerchiefs or other objects that have been mouthed first by the infected child and then by the susceptible child. Experience has shown that diphtheria infection results usually by direct exchange of the organisms of the nose and throat rather than through inanimate objects.

Dr. Chapin of Providence has well demonstrated how diphtheria contained in the secretions of the nose and mouth may be transmitted. He has brought to our attention the fact that the saliva is made use of for a great variety of purposes and that numberless articles are, for one reason or another, placed in the mouth unconsciously. "Who can doubt," says he, "that if the salivary glands secreted indigo the fingers would not continually be stained a deep blue, and who can doubt that if the nasal and oral secretions contain the germs of disease the germs will not be almost as constantly found upon the fingers?"

All successful commerce is reciprocal and in this universal trade of saliva the fingers not only bring foreign secretions to the mouth of their owner but there exchanges it for his own, distributing the latter to everything that the hand touches. This happens not once, but scores and hundreds of times during the day's round of the individual. The cook spreads his saliva on the muffins and rolls; the waitress infects the glasses and spoons; the moistened fingers of the peddler arrange his fruit; the thumb of the milkman is in his measure; the reader moistens the page of his book; the conductor his transfer tickets; the lady the fingers of her glove. Everyone is busily engaged in this distribution of saliva so that at the end of each day this secretion is found freely distributed on the doors, window sills, furniture and playthings in the home, the straps of trolley cars, the rails and counters and desks of shops and public buildings, indeed upon everything that the hands of man may touch.

The mouth, too, is put to numberless improper uses which may result in the spread of the infection. It is used to hold string, pins, pencils, paper and money. The lips are used to moisten the pencil, to point the thread for the needle; to wet postage stamps and envelopes. Children "swap" apples, cake, etc., while men exchange their pipes and women their hatpins. Sometimes the mother is seen cleansing the face of her child with her saliva-moistened handkerchief and perhaps the visitor is shortly after invited to kiss the little one. This close contact, which emphasizes the importance of education in personal hygiene based upon habits of biological cleanliness, is undoubtedly responsible for the spread of diphtheria in many instances.

It is absolutely certain that the diphtheria bacillus must gain access to the nose or throat in order to cause the disease but why do some individuals exposed contract it, while others escape? It has been recently ascertained that only certain individuals are susceptible while the remainder may harbor the diphtheria bacilli in the nose or throat and yet not develop diphtheria. Such people are known as diphtheria carriers. These individuals or carriers are protected by something in their blood which prevents the germs from doing any harm but the same bacilli may be carried to the throat of another person where there is no protection in the blood and thus give rise to a moderate or severe case of diphtheria. It is these people, the so-called carriers, who are the greatest menace to a community.

The incubation period of diphtheria is variable, lasting from a single day to a week or more. It depends upon the virulence of the organism and the amount of resistance the individual possesses. The onset

may be sudden but usually at the start the subjective symptoms of discomfort are so slight that it is difficult to fix a definite onset of the disease. Again the symptoms will vary depending upon the localization of the diphtheria. In the pharyngeal type, which is the most common, the onset is usually slow. The children feel somewhat tired and are disinclined to eat and play; they are sleepy; the voice is rather hoarse and slightly nasal. Temperature ranging from 100° to 103° may be the first symptom to alarm the mother or nurse. Early in the disease the child will complain of pain in the neck and discomfort on swallowing. If the mouth and pharynx are inspected early only slight evidences of inflammation are seen. There may be only a slimy looking deposit on the posterior pharyngeal wall with increased prominence of the pillars and tonsils. Without treatment a definite membrane will be noted on the tonsils twenty-four or forty-eight hours later which may spread by continuity until it may finally cover, like a velvet skin, both sides of the fauces, the uvula and even small spots on the posterior pharyngeal wall. If the case is a neglected one, the membrane may spread to the nostrils and down into the trachea. The general condition will gradually become worse; the pain on swallowing will increase and the glands of the neck become tender. There will be general depression and weakness. In the untreated case the outcome is very serious. With our present knowledge of this disease no case should be allowed to progress to this stage if seen by a physician or a nurse. It is the late and advanced case alone which keeps up the mortality rate in diphtheria.

Tonsillitis and certain rare throat conditions may simulate diphtheria but the final distinction can always be made by means of a culture taken from the nose or throat. If it is impossible to get the bacteriological diagnosis, no time should be lost to institute antitoxic treatment, for it will do no harm to give it for a mistaken diagnosis, while failure to inject it may be the means of permitting the disease to progress beyond the reach of antitoxin.

In the laryngeal form of diphtheria the diagnosis may be more difficult, especially if there is no evidence of trouble in the throat. This form, which is usually seen in children, has a slow onset and begins with a characteristic weakening of the voice, a short, rather brassy, cough and a more prolonged character of the breathing. Decided hoarseness develops rapidly and the cough becomes hollow and barking. If the case progresses, the respiration becomes so embarrassed that the patient is anxious as is shown by the attitude and expression. The voice and cough become almost completely silent. Inspiration

and expiration are noisy, lengthened and extremely labored. The increasing air-hunger will bring into play the voluntary muscles of respiration and as the stenosis increases and greater weakness ensues, the child takes on a bluish color. Anyone who has seen a child in this condition would never again fail to recognize the source of trouble. In any slowly-developing laryngeal trouble diphtheria should be suspected and the routine treatment given regardless of culture report.

It can be said with truth that for no other medical disease has science given to the world such a sure and simple means for a cure. The use of diphtheria antitoxin is so well known throughout the world that a discussion of its use is needless. It was a long and laborious task for the discoverers of antitoxin to convince the people of its efficacy and even in this enlightened age people, and unfortunately intelligent people, protest against its use. But our friends who saw diphtheria treated two decades ago and are following the present results must be the judges in this matter. Suffice it to say that the mortality rate of 40 to 50 per cent in pre-antitoxin days has been reduced to 8 and 10 per cent since its introduction. Rarely does a case of diphtheria die if seen early to receive antitoxin.

Diphtheria antitoxin can readily be obtained in all communities and seldom should there be a reason for delay in administering it. Recent experiments in the mode of administration and rate of absorption have shown that for immediate results the intravenous injection is the best. The intramuscular route is the most useful and safest, while the subcutaneous method is successfully employed. The individual case will decide the method as well as the dose. The object of the first injection of antitoxin shall be to neutralize all the diphtheria toxins and consequently calls for a single large dose rather than repeated smaller ones. The amount of antitoxin will vary from 4000 to 30,000 or more units at a single injection. For immunizing purposes 500 to 1000 units will be sufficient. Rarely does antitoxin produce any serious symptoms. A certain percentage of the cases will develop an urticaria which may be most annoying. This may manifest itself as early as the second day or be deferred a week or longer.

The subsequent treatment of diphtheria does not differ much from that of any acute infection. Absolute rest for at least a period of ten days is essential. In severe cases heart and kidney complications are common as well as diphtheritic paralyses. Early administration of antitoxin and absolute rest are the best means of warding off these untoward results.

The laryngeal case may require intubation. The nursing of these

children requires more care. They must be constantly watched to anticipate any trouble should the tube be coughed. The child must be fed slowly and carefully to prevent a spasm of cough which might prematurely dislodge the tube. The tubes are generally coughed the fourth or fifth day, otherwise they are extracted by means of a special instrument. It is only in the extreme cases, where intubation is impossible or does not relieve the obstruction, that tracheotomy is resorted to.

It is in the field of prophylaxis that great efforts should be made to lower the mortality of diphtheria. The isolated case of diphtheria cannot be prevented as far as our present knowledge goes but when a case appears, as it frequently does, in asylums, hospitals, schools or similar institutions every effort should be made to prevent it from spreading. By the application of well tried measures it can usually be controlled with every assurance of success. If a case of diphtheria develops in an institution, it is customary to give a prophylactic dose of antitoxin to all. Though this will protect the individuals immunized it will not prevent its spread, as the bacilli may be harbored by persons not suffering from the disease. To determine the carriers, a nose and throat culture should be taken of the exposed children and the positive cases isolated. It will frequently be found that a number of carriers exist in any large group of individuals. They are the greatest source of danger and must be removed.

Recently it has been learned that by means of a simple skin test known as the Schick test, the susceptible and non-susceptible individuals can be determined. This test consists of the injection of a minimal dose of diphtheria toxin into the skin of the forearm. A local reaction of redness indicates the absence of antitoxin in the blood and denotes that the person is susceptible to diphtheria. The absence of a reaction shows that there is sufficient antitoxin in the blood to neutralize the toxin injected and probable immunity to the disease. Where cases of diphtheria have developed in institutions this test has been tried and only those susceptible immunized, thereby obviating the necessity of giving antitoxin to all exposed. As stated before only about ten per cent of adults are in need of antitoxin for immunization while fifty per cent of children are susceptible. Unfortunately, where a case is taken from the community at large less can be done to limit its spread but with the means we have at our control epidemics in institutions should soon be checked.

Cases of diphtheria are best treated in an institution erected for that purpose but there is no great objection to treating a case in the

household provided the nurse and the patient may be quarantined from the rest of the family.

Disinfection should be applied especially to the secretions from the mouth and nose. These may be received upon a piece of gauze and burned. For the hands and other objects bichlorid of mercury 1-1000, or carbolic ( $2\frac{1}{2}$  per cent), are efficient. The bed linen, towels and other fabrics should be boiled or steamed. Evidence is accumulating that the infection usually comes from persons rather than things.

## EXPERIENCES IN THE AMERICAN AMBULANCE HOSPITAL, NEUILLY, FRANCE

BY K. K. AND M. E. H.

*New York, N. Y.*

It has been suggested that we write an account of our experiences in Paris, for the benefit of other nurses who have not yet had a chance to go to the war in Europe. We feel a certain reluctance to talk because we never really saw any active war service despite the fact that we went over with jaws set tight in determination to get to the front. We went, regardless of what it might cost us, intent only upon serving France who needed us desperately and who would surely welcome us to the duty of uttermost danger in her hour of need.

It seemed as if we had stepped right into the war as soon as we got on board *La Touraine* at her wharf in New York, for she was loaded down with horseshoes for the French cavalry, with automobiles to make ambulance cars, and barrels full of muskets and ammunition, besides 120 good men and true, going back to fight for France. They were all quite cheerful, even to the weak looking youth whose mother had come over to fetch him back to fight. There was another man of quite different stamp, whose mother drew him back to fight. He was going, he said (in spite of the fact that he had American naturalization papers), to the war, so that his mother might not feel "out of it" with no man belonging to her on the firing line! One man had come a three-weeks' journey by wagon from the interior of Mexico with his wife and eight-months-old baby. Besides these there were three priests, whom we noticed particularly, going back to the colors, and a boy who was the thirteenth in his immediate family to serve.

Finally we sighted Havre with the gray battleships hovering around her and the transports disgorging line upon line of cheering men going to "feed the guns."